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Technical Memorandum

Phase I, Task 13

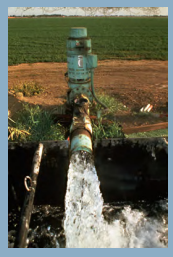
Water Management Strategies Opportunities and Constraints

Prepared for:

Upper Kings Basin Water Forum
and Kings River Conservation District

In Coordination with:

California Department of Water Resources



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PURPOSE AND INTRODUCTION

The purpose of this Technical Memorandum (TM) is to support identification of water management strategies for inclusion in the Upper Kings Basin Integrated Regional Water Management Plan (IRWMP). Work was conducted under Task 13, Identify Water Management Strategies; and Task 14, Evaluate Integration Opportunities and Statewide Priorities. A written briefing on water management strategies was provided to the Upper Kings Basin Water Forum (Water Forum) for review and discussion at the April 27, 2006 meeting. This TM elaborates on the water management strategies and provides additional information on how they may be applied in the Upper Kings Region (Region). This TM:

- Documents water management strategies that may be included by the Water Forum in the IRWMP,
- Discusses opportunities to apply and integrate water management strategies in the IRWMP Region, and
- Presents constraints to implementation of water management strategies and helps lay the foundation for defining specific programs and projects that are to be part of the IRWMP.

The Water Forum has identified the water resources problems in the Region and developed the IRWMP goals and objectives[1]. Overdraft of the Kings Groundwater Basin (Basin) is identified as the most severe water resources problem in the Region. This problem has the greatest potential to create conflicts over water, impact water supply reliability, reduce economic activity in the region, affect current agricultural production, and impact current land use plans. The IRWMP goals and objectives acknowledge the priority for resolving overdraft in the Basin by directing the focus of the IRWMP to the development of a conjunctive use and groundwater management program. The planning framework and integration developed by the Water Forum establish the process and strategy to integrate other water management strategies into the IRWMP.

DESIRED OUTCOME OF THE IRWMP

The Water Forum identified negative consequences to be avoided and anticipated benefits to be realized through development of the IRWMP. Historically, local management of the Basin was limited to independent operations by each overlying water agency and individual water users. If water agencies and users continue to act independently and seek to resolve groundwater overdraft from a local perspective, it is likely that competition and conflict will intensify; overdraft will continue; and risk for water quality impairment, land subsidence, litigation, and

[1] Vision, Problems, Goals, Objectives adopted by Water Forum, April 27, 2006.

pumping costs will increase. In addition, a combination of small local projects may not be as cost effective as regional programs or larger projects with multiple participants. On the other hand, anticipated key benefits of a regional approach include:

- Establishment of goals and policies for the most economical and best use of available water resources in the Region;
- Effective management of overdraft in the Basin as a whole;
- Reduced potential for conflicting goals/projects among those who share the same river and Basin;
- Improved local and regional water supply reliability and drought protection;
- Cost effectiveness of large regional projects as compared to multiple small local projects;
- Reduced cost of developing one regional plan versus individual agency plans;
- Increased operational flexibility of the water infrastructures in the Region for common benefit;
- Reduced potential for conflicts and litigation;
- Protection and improvement of groundwater quality;
- Shared development and use of the same hydrologic model and analytical tools for project evaluation;
- Reduced cost of data collection, sharing, and management; and
- Increased chance of obtaining state grant funds as a region, rather than as a local agency.

It is anticipated that the IRWMP will preserve the agricultural economy while accommodating planned urban growth. It also may be assumed that by working together, the Region will achieve increased political influence and therefore will be more capable of leveraging local funding with state and federal grants.

It should be noted that some projects may only provide local benefits and/or improvements may be needed to meet regulatory requirements within one jurisdiction only. The economic analysis conducted for the IRWMP will help local agencies and the Water Forum evaluate those projects that provide local and regional benefits so that appropriate cost-sharing arrangements can be developed. It is expected that technical analysis associated with development of the IRWMP will provide valuable data and information to support local decision-making by both land use and water agencies.

WATER MANAGEMENT STRATEGY AND INTEGRATION THEME

Conjunctive Use and Groundwater Management, two of the key water management strategies recommended by the California Department of Water Resources (DWR) for an IRWMP, constitute the integrating theme for the Kings Region IRWMP. These water management

strategies and their relationship to other recommended water management strategies for an IRWMP are addressed in this and later sections of this TM.

Table 1 provides a summary of the water management strategies, defining how they may be integrated with the primary theme of conjunctive use and groundwater management; and listing project opportunities, constraints, and overall potential in the Region.

CONJUNCTIVE USE

Conjunctive use, also referred to as conjunctive management, is the coordinated and planned management of both surface and groundwater resources in order to maximize their efficient use. Conjunctive management is used to improve water supply reliability and environmental conditions, reduce groundwater overdraft and land subsidence, and protect water quality.

In-Lieu Recharge for Fresno and Clovis

The Cities of Fresno and Clovis constructed surface water treatment plants in 2004 to use Kings River and Central Valley Project (CVP) water in lieu of pumped groundwater. This action increases the overall reliability of the supplies for both cities.

Primary components to a conjunctive use program include recharge, use modification, and monitoring. The first component is to recharge groundwater when surface water is available to increase groundwater storage in the underlying aquifer. Recharge can be accomplished in two ways: (1) direct recharge by allowing water to infiltrate through recharge ponds or by injecting water into the aquifer using wells, and (2) indirect recharge (also called in-lieu recharge) by substituting groundwater pumping with surface water delivery. The second component of a conjunctive use program is to modify the water use and switch to groundwater use during dry periods when surface water is scarce. The third component is to have an ongoing monitoring program to evaluate and allow water managers to respond to changes in groundwater, surface water, or environmental conditions that could violate management objectives or impact other water users. The Region has a long history of conjunctive use by Alta Irrigation District (AID), Consolidated Irrigation District (CID), Fresno Irrigation District (FID), and others in the Region, and has achieved significant benefits from the projects that have been implemented (Kings River Conservation District [KRCD], 1979). Kings River water is intentionally stored in the Basin during years of above-average surface water supply for later use in dry years. Groundwater overdraft continues despite these very positive programs; however, these programs have certainly resulted in reduced overdraft, and there are opportunities to further expand and improve on the current conjunctive use program.

Table 1. Upper Kings Basin IRWMP: Conjunctive Use and Groundwater Management Relationships, Opportunities, and Constraints

Water Management Strategy	Relationship with Conjunctive Use and Groundwater Management	Project Opportunities	Constraints	Notes	Overall Potential for Upper Kings Basin
Conjunctive Use* and Groundwater Banking*					
Conjunctive Use and Groundwater Banking	High	Surface water sources - Kings River floodwater and entitlements, Friant CVP Class 1, Class 2, and 215. Regional and subregional ponds and facilities within AID, FID, and CID. In-lieu surface water delivery and treatment for urban area. Inter-regional groundwater banking and storage with external third parties. Coordinate recharge functions with local stormwater retention/detention facilities. Include environmental/habitat features into facility designs and operations. Provide recreation benefits at recharge operations.	Gaining consensus with other KRWA members, negotiating necessary agreements. Evaluating benefits and distributing costs, defining revenue sources and governance. Currently no regional groundwater management plan to guide groundwater basin operations.	Primary theme for integrating other management elements. Could recover costs by selling sand and borrowing materials. Could be related to gravel mining operations and recovery plans.	High
Groundwater Management	High	Integrate existing GMPs. Meet SB 1938 requirements through IRWMP.			High
Conveyance Facilities**	High	Use existing or expanded AID, FID, CID facilities when capacity is available to increase operational flexibility. Develop new conveyance facilities to deliver surface water in lieu of groundwater to agricultural areas not currently served (i.e., Raisin City). Develop easements for spreading floodwaters. Use existing facilities or develop new facilities to convey surface water for treatment and use in municipal areas in lieu of groundwater pumping. Develop new facilities where needed to convey imported water from Mendota Pool or San Joaquin River. Develop agreements to use other KRWA facilities.	Capacity constraints for conveying flood water. Some areas lack conveyance (e.g., Raisin City). Funding mechanisms need definition. Expansion within existing easements or agency-owned property. Need to acquire land or easements to build or enlarge conveyance facilities. Time needed to comply with CEQA.	Need to evaluate available canal capacities and map current facilities.	High
Land Acquisition**	High	Acquire land to develop recharge facilities. Develop easements for spreading floodwater. Apply land use policies to develop mitigations for urban areas facing development pressure in over drafted basin and resolve problems complying with state laws (SB 610 and SB 221).	CEQA review required for land acquisition. Land acquisition costs are rising under development pressure.	Necessary part of conjunctive use and groundwater recharge strategy. Can demonstrate near-term success. Complete evaluation of recharge area potential.	High

* Indicates water management strategy that must be considered pursuant to the Water Code.
** Indicates water management strategy added by the Water Forum.

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Water Management Strategy	Relationship with Conjunctive Use and Groundwater Management	Project Opportunities	Constraints	Notes	Overall Potential for Upper Kings Basin
Other Water Management Strategies					
Import, Transfer, and Exchange	Medium to High	Potential source for Region. Direct purchase of 215 floodwater, San Joaquin River Water, or CVP or SWP water via Delta-Mendota Canal and Mendota Pool. Reservoir reoperation - carry over water stored in groundwater aquifer. In-basin transfers with KRWA members through operational changes. In-lieu pumping of stored water and transferring surface water to a third party. Coordinate groundwater banking with CVP/SWP contractors seeking to store water. Crop idling, crop shifting, or water use efficiency measures. Reducing return flows and seepage that would not otherwise be recoverable for reuse.	Costs of water purchase and statewide competition. Requires contracts with external parties. No local history of import or banking, fear of loss of local control from banking, political acceptability. Water rights issues. Local resistance to outside influences.		Medium to High
Wastewater Recycling*	Medium	City of Clovis recycled water program. Expanded use of Fresno/Clovis regional wastewater treatment facility. Selma-Kingsburg-Fowler regional treatment plant. City of Dinuba wastewater reuse program.	Unquantified recycled water potentials. Treatment facilities not near potential place of municipal use. Very little wastewater currently flowing out of the Region. Regulatory uncertainty (DHS). Need substantial investments in additional infrastructure. Public opinion and acceptance.	Recycled water projects supported by the state. Cost effectiveness needs to be evaluated for both IRWMP and UWMPs. Not likely to be cost effective for smaller cities and facilities.	Medium to Low
Water Conservation*	High	Drought contingency and operations plans tied to water banking agreements. Increase water use efficiency for urban and agriculture through implementation of BMPs approved by Urban Water Conservation Council and Agricultural Water Management Council. Improve monitoring and measurement of water delivered and produced.	Requires private sector investments in technology and changes in management practices. Current programs are voluntary and may be underfunded; regulatory programs are not politically acceptable.	Should be a common element to all alternatives. Current cities with 3,000 service connections must update UWMP every 5 years. Agricultural water management plans not required but have been prepared by some districts.	High
Surface Water Storage	Medium to High	Additional surface storage would help regulate currently uncontrolled streamflow. Pine Flat Reservoir and upstream reservoirs - storage and operational modification. Prior project proposals: Rogers Crossing Reservoir, Dinkey Creek, Big Dry Creek, Mill Creek, Raise Pine Flat, and Pine Flat Afterbay Storage.	Building large-scale surface storage is difficult due to high costs and environmental constraints.	Could be part of long-term strategy involving multiple regional partners. Would help capture and manage flood flows, Eliminate from near- and mid-consideration. Keep as potential long-term strategy.	Low

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Table 1. Upper Kings Basin IRWMP: Conjunctive Use and Groundwater Management Relationships, Opportunities, and Constraints

Water Management Strategy	Relationship with Conjunctive Use and Groundwater Management	Project Opportunities	Constraints	Notes	Overall Potential for Upper Kings Basin
Desalination	Low	No significant opportunities within the Region.	Cost effectiveness, no source of saline water.	Eliminate from further evaluation.	Low
Flood Plain Management					
Flood Plain Management*	High	Develop policies to mitigate flood impacts from urban development, tie to recharge program. Move water from Kings River during flood operations to combined groundwater recharge, storage, and retention facilities and reduce threat of downstream flooding. Obtain flood plain easements for recharge and spreading of Kings River floodwaters. Current funding and policy emphasis on floodplain and levy improvements.	Interagency coordination required. Specific levy improvements not well identified or defined.	Fresno area provides good examples of policy concepts. AID also has integrated some stormwater policies to facilities improvements to mitigate development impacts to agricultural distribution systems.	High
Stormwater Capture*	High	Kings River flood releases are available for capture and salvage. FID, AID, CID provide stormwater benefits and integrate into existing canal operations to reduce downstream impacts of urban development. Develop combined recharge/retention facilities and acquire land for on- or off-site mitigations to stormwater impacts from new development. Develop stormwater facilities to incorporate open space elements.	Need funding mechanisms and interagency agreements. Need to acquire land through easement or purchase.		High
Water Quality					
Surface Water Treatment for Drinking Water	High	AID UWMP and in-lieu surface water treatment program. Evaluate CID potential to provide surface water to urban uses in lieu of groundwater pumping. City of Fresno considering additional surface water treatment for future southeast area development. Work with disadvantaged communities to evaluate needs for drinking water treatment.	Feasibility and cost effectiveness need further study. Increased cost over current groundwater use.		High
Wastewater Treatment	Low	Groundwater recharge with treated wastewater (program integrated to reclamation and reuse potential).	Current plants disposing through land application or percolation of wastewater consistent with RWQCB permits and requirements.	Only one plant discharges to surface water in the region.	Low
Water Quality Protection and Improvement*	Medium to High	Increase recharge of Kings River water into aquifers to improve water quality. Coordinate with existing programs.			Medium
NPS Pollution Control	Medium to High	KRCD continues to implement Kings River agricultural waivers program. Seek to integrate and coordinate existing programs. Develop voluntary cooperative efforts to encourage implementation of BMPs.			Medium

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Table 1. Upper Kings Basin IRWMP: Conjunctive Use and Groundwater Management Relationships, Opportunities, and Constraints

Water Management Strategy	Relationship with Conjunctive Use and Groundwater Management	Project Opportunities	Constraints	Notes	Overall Potential for Upper Kings Basin
Ecosystem					
Ecosystem Restoration*	High	Integrate ecosystem features into any planned groundwater recharge and banking program where feasible. Specific restoration project opportunities not defined.	High costs, available lands.	Continue to work with environmental stakeholders to define opportunities.	Medium
Environmental and Habitat Protection and Improvement*	High	Continue to implement Kings River Fisheries Management Program.	Funding.	Existing program is well defined.	High
Wetlands Enhancement and Creation*	High	Ability to integrate design criteria into development of recharge facilities. May design wetland features into operational storage facilities. Wetlands creation with wastewater. Federal funding available via USDA Wetlands Reserve Program.	Could increase costs; create invasive species habitats; endangered species spill over onto adjacent lands.	All ecosystem elements in this section also could serve to increase open space and active/passive recreation opportunities.	High
Land Use and Recreation					
Land Use Planning	High	Integrate land and water supply plans where appropriate, meet current and future water needs, streamline subsequent project reviews, and avoid future legal challenges or project delays. Coordinate local stormwater planning with water districts to reduce and mitigate for increased urban runoff.	Timing to develop policies and gain consensus, political acceptability.		High
Recreation and Public Access*	Medium	Implement elements of the KRCD vision for the Lower Kings River Basin. Seek to include open space elements in recharge project facilities where feasible.	Limited institutions and no master parks plan.	Kings River Conservancy has defined a plan for the reaches below Pine Flat to Highway 99.	Medium

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An expanded conjunctive use program will optimize available Kings River water and the combined storage in Pine Flat Reservoir and the Basin. Pine Flat Reservoir captures, conserves, and manages runoff from the Kings River (rainfall and snow melt) for subsequent release to Kings River Water Association (KRWA) entities that hold water rights to the Kings River. AID, CID, and FID historically have delivered surface water to areas in lieu of groundwater pumping and intentionally have recharged surface water at dedicated facilities. The history of success, familiarity with conjunctive use operations, and demonstrated benefits of such approaches should make it easier for the area to further expand the conjunctive use program.

Expanding the IRWMP Region conjunctive use opportunities will involve engineering decisions that include defining:

- Surface water sources;
- Conveyance pipelines and canals;
- Land for spreading or recharge; and
- Stored water extraction and ultimate use.

Surface water sources include unregulated Kings River flood releases and other local stormwater; Friant Unit of the CVP Class 1 and Class 2 contract water and unregulated floodwater ("215 floodwater"); and imported water obtained through purchase, exchange, or transfer.

The California State Water Resources Control Board (SWRCB) has declared the Kings River to be fully appropriated. This means that there is no "new" surface water available for appropriation from the Kings River because the water already is committed through the complex systems of water rights and agreements existing among members of KRWA. Although the Kings River is fully appropriated, there is unregulated floodwater that flows out of the Region that can be captured and managed for groundwater recharge.

Members of the Water Forum (City of Fresno, FID) have access to CVP Class 1 and Class 2 federal contract water from the San Joaquin River. 215 floodwater historically has been imported into the Region through the Friant-Kern Canal where it crosses the Kings River.

There also may be opportunities to further develop facilities to allow access to sources of surface water from outside the Basin. The lower part of the Basin includes the Mendota Pool, the terminus of the Delta-Mendota Canal of the CVP that imports water from the Sacramento-San Joaquin Delta. The Mid-Valley Canal previously has been conceived as a project to allow for import of water into the Region, and a variant on

Available Surface Water and Groundwater Storage

Pine Flat Reservoir can store upwards of 1,000,000 acre-feet (af) of water. The Basin has an available storage capacity of 93,000,000 af to a maximum depth of 1,000 feet (DWR, 2006 Bulletin 118 Basin Description). This volume of groundwater storage represents a valuable asset to develop and expand groundwater storage and banking.

the prior project could be developed to convey imported water. As discussed later in this TM, highly treated recycled wastewater may also be a "new" source of supply if this water is used in lieu of groundwater or is recharged through the recharge ponds.

Conveyance pipelines and canals within AID, CID, and FID can be used to deliver available surface water for in-lieu or direct recharge. The IRWMP Region has a well engineered as-built environment, and these facilities are adequate to distribute the available surface water supply in all but the wettest years. Changes in current operations, expansion of existing conveyance facilities, or new facilities may be needed to fully realize the conjunctive use potential of the IRWMP Region and convey water from the sources identified above. Conveyance is discussed in more detail later in this TM.

Access to additional **land for spreading or recharge** is needed through easement or purchase if conjunctive use and groundwater recharge operations are to be expanded in the IRWMP Region. Initial review of the engineering and hydrogeologic conditions indicates that there are lands adjacent to or near existing conveyance facilities that are appropriate for development of additional recharge facilities. The conditions vary across AID, CID, and FID, and additional work needs to be conducted to further characterize recharge potential. In general AID, CID, and FID all have potential for additional direct recharge facilities. In areas with high groundwater use and low recharge rates, in-lieu recharge is more suitable than direct recharge. Land acquisition and protection of recharge areas are discussed in more detail later in this TM.

There are areas in the lower portion of the groundwater basin, but outside the IRWMP Region, that are solely reliant on groundwater for agricultural irrigation. These lands overlay an area with extensive groundwater storage space and could be an important part of the conjunctive use program.

The **stored water extraction and ultimate use** includes defining facilities and operating guidelines for the Basin. Extraction could include construction of new wells for redistributing the supply, but more likely water would be removed using existing wells during dry periods when surface water is not available. If water banking and inter- or intra-basin exchanges or transfers are part of the conjunctive use program, it is likely that existing facilities and contractual arrangements will be needed.

Specific opportunities to expand conjunctive use and groundwater recharge will be identified and considered by the Water Forum for inclusion into the IRWMP. The Water Forum should consider a course of action, including:

- Working within AID, FID, and CID to develop additional regional conjunctive use program facilities for groundwater storage within their jurisdictions;
- Collaborating to develop regional conjunctive use program facilities for groundwater storage and banking that include transfer and exchange agreements within the IRWMP Region; and

- Seeking opportunities for intra-regional conjunctive use programs that include water importation and groundwater banking involving third parties.

Constraints

There is a limited amount of unregulated, unallocated stormwater within the IRWMP Region; this water comes as high flow over short durations. The water also comes at times when the existing conveyance facilities may be full and are being used for flood operations, thus limiting the ability to convey additional water. The same is true of the 215 floodwater, which is available when it cannot always be used. 215 floodwater also is more expensive in relation to local Kings River supplies and historically has not been purchased, even when made available by the U.S. Bureau of Reclamation (USBR). As discussed later in this TM, imported water obtained through transfer may be constrained by regulatory, economic, or political circumstances.

There are conveyance capacity limits that reduce the ability to move surface water when it is available to areas where it could be recharged or used in lieu of groundwater pumping, and there are areas that may be used for both in-lieu or direct recharge that do not have any conveyance facilities.

Within the IRWMP Region, access to land, either through easement or purchase, has constrained the development of recharge basins and limited spreading operations. Land acquisition has been constrained by lack of ready cash for public agencies to respond when land is on the market and time delays associated with environmental review by public agencies when purchasing land for specific projects.

Some candidate areas for increasing in-lieu or direct recharge are outside of KRWA's place of use and/or lack conveyance facilities to transport water to areas with ample and available groundwater storage space. This includes the Raisin City Water District in the Lower Basin where agricultural users rely exclusively on groundwater. This area could be encouraged to take "in-lieu" surface water in extremely wet years to reduce reliance on groundwater or participate in an expanded intentional recharge/banking program using imported water if institutional and engineering barriers can be overcome.

Institutional constraints to conjunctive use are related to economics and legal and political conditions[2], including:

- Inability of local and regional water management governance entities to build trust, resolve internal and external differences, and share control;
- Inability to match benefits and funding burdens in ways that are acceptable to all parties, including third parties;

[2] Source: National Water Research Institute (1998), in cooperation with the Association of Ground Water Agencies and the Metropolitan Water District of Southern California.

- Lack of sufficient federal, state, and regional financial incentives to encourage groundwater conjunctive use to meet statewide water needs;
- Legal constraints regarding storage rights, basin judgments, area of origin, water rights, and indemnification;
- Inability to address quality difference in "put" versus "take" water; standards for injection, export, and reclaimed water; and unforeseeable future groundwater degradation;
- Risk that water stored cannot be extracted when needed because of infrastructure, water quality or water level, politics, and institutional or contractual provisions;
- Lack of assurances to prevent third-party impacts and increase willingness of local citizens to participate;
- Lack of creativity in developing lasting "win-win" conjunctive use programs and agreements; and
- Different roles and expectations of supplemental suppliers and water managers in relation to conjunctive use.

None of the constraints provide fatal flaws that would eliminate the possibility to expand current conjunctive use programs, and the Water Forum can develop strategies to overcome any of the challenges. However, resolving the institutional issues and developing agreements to take advantage of the opportunities is a more daunting challenge than solving engineering problems, designing additional facilities, or revising operations.

Groundwater Management

DWR has identified six methods of groundwater management in California (DWR, 2003), including identification of management authority and extent (parenthesis) in the chronological order in which they have been developed:

- Overlying Property Rights (property owner);
- Statutory Authority (legislatively defined local agency or district);
- Groundwater Management Districts or Agencies (legislatively defined local agency or district);
- Groundwater Management Plan (GMP) (local agency or district);
- Adjudicated Groundwater Basins (groundwater basin, water master, or court); and
- City and County Ordinances (city or county).

It is apparent that there can be overlapping jurisdictions and multiple approaches to groundwater management. If groundwater management is not developed appropriately, the presence of multiple jurisdictions can lead to complicated and potentially conflicting groundwater management approaches within the IRWMP Region.

Within the IRWMP Region, groundwater management has been practiced primarily by the overlying property owners. This is especially true outside of AID, CID, and FID in areas where there is no organized water district that could develop a GMP.

Within the IRWMP Region, none of the overlying water districts has been granted statutory authority to manage groundwater by the legislature. GMPs have been prepared by AID and FID. FID updated their GMP in 2005 to meet the new state standards (SB 1938). CID has not developed a GMP. The Lower Basin has a GMP that meets the most recent state requirements and includes the Raisin City Water District. (WRIME/KRCD, 2005)

The courts have not adjudicated the Basin. Adjudication is a complex and confrontational legal process that is used to define groundwater rights. It is costly, contentious and takes many years. Adjudication should be avoided through a negotiated and consensus-based approach to resolving groundwater issues and developing local management plans.

Local counties can use their police powers and authorities to adopt ordinances and regulate groundwater. Fresno County has adopted a groundwater ordinance to require permits for groundwater export, and the intent is to hold project proponents accountable for impacts that may occur as a result of proposed export projects. Neither Kings nor Tulare Counties have adopted a groundwater ordinance.

The IRWMP is an opportunity to further evaluate how to cooperatively manage the Basin. Within the IRWMP Region, there is no integrated system to manage groundwater to ensure equity, efficiently allocate resources, and solve overdraft. KRWA has mature surface water management and institutional arrangements, but there is no similar set of agreements to locally manage and protect groundwater. The IRWMP is an opportunity to solve overdraft, develop and implement projects, create the management system to increase the Basin's yield, share monitoring costs and data, avoid conflicts, and reduce the potential for litigation over groundwater. Integrating regional GMPs that meet updated state requirements should be further considered, and their key features should be incorporated into the IRWMP.

Constraints

The constraints to improving groundwater management are similar to those for conjunctive use. Appropriate institutional and financial arrangements need to be developed to identify how to govern the groundwater basin, develop projects, make use of available groundwater storage, raise funds for new projects, and overcome political resistance and legal impediments to conjunctive use. Current institutional arrangements to manage surface water and groundwater do not provide incentives to improve groundwater recharge operations in wet years, and the cost of overdraft is not internalized into current rates for urban or agricultural users.

Conveyance Facilities

Conveyance provides for the movement of water from the source to areas of need and includes natural channels and constructed facilities such as canals, pipelines, pumping plants, and diversion structures. Within the Region, AID, FID, and CID all operate and maintain extensive infrastructure for conveying water from the Kings River to recharge facilities and current users. The Friant-Kern Canal of the CVP also is used to bring water from the San Joaquin River into the Region. The Region's groundwater aquifers also convey water from recharge areas to areas of pumping. Conveyance facilities range in size from small, local end-user distribution systems to large systems that deliver water to or drain water from the Region. Specific objectives for natural and managed water conveyance activities include urban and agricultural water deliveries, flood management, consumptive and non-consumptive environmental uses, water quality improvement, and recreation.

The IRWMP will identify needed conveyance improvements to get water from the available sources to existing, improved, or new groundwater recharge facilities. Existing or improved conveyance facilities also may be used in lieu of groundwater pumping to deliver water to expanded places of use for agriculture or to surface water treatment facilities for urban use. Specific opportunities for consideration by the Water Forum include:

- Using existing or expanded conveyance facility capacities to move surface water to existing or new recharge sites or agricultural areas not currently served,
- Developing new conveyance facilities to increase operational flexibility and provide surface water in lieu of groundwater pumping to areas currently not receiving water,
- Using existing or new conveyance facilities to move surface water to urban areas for treatment and use in lieu of groundwater, and
- Developing conveyance facilities to connect the Mendota Pool to recharge facilities or irrigated areas in the Raisin City area.

The main benefits of conveyance to the urban, agricultural, and environmental water use sectors are maintaining or increasing water supply reliability, protecting water quality, augmenting current water supplies, and providing operational flexibility. For the environmental sector, benefits may include in-stream flows as well as appropriate temperatures and water quality for aquatic and riparian habitat. It is important to recognize that in some cases, improving water supply reliability through system flexibility is just as valuable as increasing overall supply. Indeed, conveyance capacity improvements can enhance reliability without augmenting supplies or reducing demand by increasing system operational flexibility.

Land Acquisition and Protection of Recharge Areas

Land is needed for development of conjunctive use facilities. Recharge of floodwater, locally controlled surface water, or imported water requires access to land through easement, lease, or purchase.

Development pressure in urbanizing areas can result in loss of prime recharge areas to municipal land uses, increased runoff from impervious surfaces, and reduced recharge. Municipal development in the IRWMP Region has typically relied on groundwater pumping, whereas prior agricultural uses relied primarily on surface water deliveries. The reduction in applied water upon conversion from agriculture to urban uses will reduce incidental groundwater recharge from agricultural irrigation water.

Specific opportunities for consideration by the Water Forum for integration into the IRWMP include:

- Implementation of a rural land acquisition program to purchase land in areas with high recharge potential;
- Development of groundwater recharge easements with private land owners to spread floodwaters on fallow lands; and
- Protection of recharge areas and development of mitigation strategies using local land use policies.

Recharge Area Protection

The Fresno General Plan has policies to protect recharge areas. The General Plan policies of the Cities of Clovis and Fresno also seek to preserve recharge areas for use as recharge/retention ponds. FMFCD purchases land in areas slated for development in order to build both recharge and retention ponds.

A land acquisition program to obtain control of lands through easement (for spreading) or purchase (for direct recharge facilities) would help overcome constraints to expanding conjunctive use and would allow Water Forum participants to respond more quickly to opportunities when land comes onto the open real estate market.

As part of the IRWMP feasibility analysis, favorable recharge areas will be mapped and evaluated for environmental constraints and impacts. A land acquisition program also can be designed and reviewed at a programmatic level pursuant to the California Environmental Quality Act (CEQA). Land could be pre-certified for acquisition under this approach, and the environmental review process can be expedited. This will facilitate public agency procurement of a specific property for recharge purposes. Easements or contractual arrangements could be used to work with private land owners to spread Kings River floodwater and provide recharge benefits.

Local city and county land use agencies can apply their land use authorities and develop policies to protect recharge areas or require mitigation for groundwater impacts associated with new development. Recharge areas can be protected to allow for natural recharge, development of groundwater recharge facilities, and mitigation of the effects of land conversion. Recharge areas in rural locations and natural stream corridors can provide multiple benefits for open space, flood control, and habitat in addition to the water supply benefits.

INTEGRATION WITH OTHER WATER MANAGEMENT STRATEGIES

To help local stakeholders develop their IRWMPs, DWR has proposed water management strategies that provide tools to build a solution and are opportunities to address problems identified by the Water Forum. The Water Forum developed the Planning Framework and Integration Strategy for the IRWMP, combining the water management strategies into five primary categories to define specific projects and programs and support program integration. This section describes and evaluates the following specific water management strategies in relation to the conjunctive use and groundwater management, the integrating theme of the IRWMP:

- Water Importation, Transfers, and Exchanges;
- Wastewater Recycling;
- Water Conservation;
- Water Supply Reliability;
- Surface Storage;
- Desalination;
- Water Quality Management;
- Floodplain Management and Stormwater Capture; and
- Ecosystems Management.

WATER IMPORTATION, TRANSFERS, AND EXCHANGES

The purpose of a program to import, transfer, or exchange water into the IRWMP Region is to obtain a new source of supply, increase supply reliability, and reduce or eliminate overdraft. Water transfers are defined in the California Water Code as a temporary or long-term change in the point of diversion, place of use, or purpose of use as a result of a transfer or exchange of water or water rights. Water transfers and exchanges are a business deal among willing participants and have become part of the water management landscape, although they may be a source of much discussion and controversy and often are constrained by state and federal requirements.

Water transfers may increase the flexibility of the Kings River water management system and may be linked to other conjunctive management strategies, including surface water and groundwater storage and banking, conveyance efficiency, water-use efficiency, water-quality improvements, and planned crop shifting or crop idling. Multiple agencies could be involved, and transfers and exchanges can be quite complex.

Generally, water for transfer is made available for transfer by six major sources:

- Direct sale or transfer;

- Transfer from storage of water that otherwise would have been carried over to the following year, with the expectation that the reservoir will be refilled during the wet season coupled with a groundwater-banking program;
- Groundwater pumping in lieu of historically used surface water delivery and transfer of the surface water rights to a third party;
- Transfer of previously banked groundwater by either directly pumping and transferring groundwater or pumping groundwater for local use and transferring surface water rights;
- Reduction of existing consumptive use through crop idling or crop shifting or by implementing water use efficiency measures; and
- Reduction of return flows or seepage losses in conveyance systems that otherwise would not be recoverable for reuse.

Specific importation, transfer, or exchange opportunities have not been defined but could include a number of in-basin or inter-basin concepts.

In-Basin Water Transfers or Exchanges

In-basin transfers could involve operational changes to existing facilities or new facilities that seek to maximize conjunctive use opportunities and groundwater storage. In-basin transfers historically have occurred between KRWA member water districts. KRWA members could increase conjunctive use and reduce the amount of surface water that flows out of the Basin in wet years. Water held by KRWA members can be readily moved, transferred, and exchanged within the KRWA boundary (place-of-use [POU]), and SWRCB review is not required for such in-basin transfers as long as the water would be used in the KRWA POU. Agencies with surface water rights to Kings River could make water available to other KRWA members with limited water rights through willing buyer/seller agreements, and KRWA members could increase conjunctive use and reduce the amount of surface water that flows out of the Basin in wet years.

Water-rights issues would need to be resolved through KRWA and SWRCB, if required, to facilitate transfers or exchange outside of the POU. This includes projects in the Raisin City Water District. In-basin transfers to those outside of the POU that do not rely on Kings River water rights could be integrated into an in-lieu recharge program. Such transfers or exchanges may be subject to SWRCB review.

Inter-Basin Water Transfers or Exchanges

Inter-basin transfers could create a new source of water for the IRWMP Region to increase available water supplies, improve supply reliability, and make use of available groundwater storage. Inter-basin transfers and importation of water from the San Joaquin River via the Friant Unit of the CVP historically have occurred. Such arrangements also can reduce project and operating costs. Successful examples of inter-basin transfers, exchanges, and groundwater

banking exist in the San Joaquin Valley and include the Kern, Arvin-Edison, and Semi-Tropic projects.

In the most basic case, water agencies and purveyors can make long- or short-term purchases and import water from willing sellers to supplement their local supplies, conveying water through existing facilities. One very specific opportunity for inter-basin transfer includes the purchase of additional 215 floodwater for groundwater storage when this water is available. There may be other opportunities for direct purchase and transfer of inter-basin water, but none have been specifically identified at this time.

Inter-basin water transfers or exchanges also could be part of an IRWMP Region groundwater banking program that involves importation of water from an outside source, groundwater banking in the IRWMP Region, and extraction (and export) or exchange of the imported water. Under such a program, a percentage of the imported water would be left behind for use within the IRWMP Region. If such water were to be exchanged for other sources, conditions favorable to both interests would need to be negotiated. Favorable financial arrangements could result in revenues to reduce costs to local participants while also increasing the water supply and improving reliability.

Both in-basin and inter-basin water management strategies are viable in the IRWMP Region. Opportunities to increase the IRWMP Region water supplies through importation, transfer, or exchange would occur in the context of complex and evolving statewide policy environment where there is increased competition between regions and between water users. There are a range of engineering and institutional constraints related to:

- The need for facilities to connect to, or wheel water through, the major systems used to move water into the Region (Friant, Kern, and Delta-Mendota [the California Aqueduct]);
- Consistency with KRWA and other local policies;
- Local and state political acceptability;
- Complex regulatory compliance requirements;
- Price and competition;
- Settlement agreements associated with restoration of fisheries on the San Joaquin River; and
- CVP/State Water Project (SWP) contractor and operator issues in the Delta.[3]

WASTEWATER RECYCLING

[3] SWRCB terms and conditions that affect SWP and CVP operations and water rights have been established via the Water Quality Control Plan for the Delta (1995); D1485 (1978); D1594 (1983), Order WR 84-2 (1984) defining Standards Permit Term 91 to protect CVP and SWP stored water; and D1641 (2000).

The state is supporting the use of reclaimed wastewater as documented in the SWP and the recommendations of California's Recycled Water Task Force (DWR, 2006, 2003). The California Department of Health Services (DHS) has produced "The Purple Book," which contains health laws related to reuse of recycled water (DHS, 2001b). DHS defines the appropriate legal uses based on the level of treatment (primary, secondary, or tertiary). Use of secondary treated wastewater is more limited than for tertiary treated wastewater[4]. Tertiary treatment is the highest level of treatment, and this water can be used for most non-potable municipal uses and groundwater recharge operations.

Fresno- Clovis Recycled Water Use

The Cities of Fresno and Clovis jointly operate an 80 million gallon-per-day (MGD) capacity wastewater treatment plant (WWTP) that sends 10% of the effluent to irrigation and the remainder to percolation ponds, to be reclaimed by pumping wells for further irrigation of non-food crops. Through an agreement with FID, the cities receive 1 af of surface water for every 2 af of water pumped into FID's canals.

California has the potential to recycle up to 1.5 million af per year of water by the year 2030. Local recycled water potential in the Region has not been quantified, but use of recycled water could free other water supplies and help meet a percentage of the municipal and agricultural water needs associated with projected population growth. To achieve that potential, the IRWMP Region would need to make investments in additional infrastructure to produce and deliver the recycled water. The cost effectiveness of this water management strategy needs to be compared to other approaches to improving water supply reliability and increasing the overall yield of the IRWMP Region.

Use of recycled water in lieu of groundwater pumping for non-potable uses, including agriculture, would allow more water to remain in groundwater storage. Some of the local general plans recognize the opportunity and encourage recycling of wastewater where cost effective. Allowable uses that may occur in the IRWMP Region for disinfected tertiary recycled water include:

- Food crops, including all edible root crops, where recycled water comes into contact with the edible portion of the crop;
- Parks and playgrounds, schoolyards, residential landscaping, and unrestricted-access golf courses;
- Industrial cooling where use of a cooling tower is involved;
- Flushing toilets and urinals, priming drain traps, industrial processes that may come into contact with workers, structural firefighting, decorative fountains, commercial laundries, consolidation of backfill around potable water pipelines, and car washes; and
- Any other irrigation use not prohibited.

[4] California Health Laws, Title 22, § 60304. Use of recycled water for irrigation.

There is a need to involve the public early in the decision-making process and provide facts early in the project planning phase where reclaimed water use is proposed.

Currently there is very little wastewater discharged directly to the Kings River, and therefore, very little wastewater currently is flowing out of the IRWMP Region. Wastewater currently is disposed of by irrigating non-food or fiber crops, evaporating, or percolating to groundwater. Historically, groundwater aquifers have received incidental recharge of secondary treated wastewater in the IRWMP Region.

Clovis Recycled Water Project

In 2001, the Clovis City Council approved a sewage system Master Plan that required construction of a sewage treatment and water reuse facility to treat effluent generated by new growth areas to a level such that the water can be reclaimed for use within the city. The plant will produce Title 22 disinfected tertiary treated water with unrestricted use.

DHS regulations governing groundwater recharge are in a state of flux (DHS, 2006), resulting in regulatory uncertainty to WWTP operations and potential users of recycled water for groundwater recharge. Because groundwater aquifers serve as potable water sources, groundwater recharge with reclaimed water is considered an indirect potable reuse, and DHS requires tertiary treatment. This could constrain existing wastewater disposal systems that rely on groundwater percolation of secondary treated wastewater, even though tertiary treatment requirements for groundwater recharge operations are more restrictive than the typical requirements for discharges to inland surface or coastal waters.

There are successful indirect potable reuse projects involving groundwater recharge in California, and new projects continue to be proposed. However, in some instances, the public has not been receptive to the concept of using recycled water to recharge groundwater basins that serve as drinking water supply sources. Groundwater recharge projects that use reclaimed wastewater would require DHS and Regional Water Quality Control Board approvals based on relevant aspects of the specific project, including effluent quality and quantity, spreading area operations, soil characteristics, hydrogeology, residence time, and distance to withdrawal.

Specific recycled water opportunities and benefits will be reviewed in greater detail for:

- The City of Clovis' recycled water program;
- Expanded use of the Fresno/Clovis regional wastewater treatment facility;
- The Selma-Kingsburg-Fowler regional treatment plant; and
- The City of Dinuba's wastewater reuse program.

Other critical issues include lack of local funding for water recycling infrastructure, research on emerging contaminants, public health concerns, regulatory compliance, and user acceptability and marketability of reclaimed water.

WATER CONSERVATION

Water conservation for agricultural and urban water users includes implementation of best management practices (BMPs) to ensure that water put to beneficial service is used cost effectively and efficiently. The goal is to reduce use where such use would have a negative effect on the environment in terms of diversion from a stream course or contribution to overdraft of a groundwater basin.

AID, FID, and KRCD are signatories to the Agricultural Water Management Council. These signatories agree to implementation of:

- Efficient Water Management Practices, including:
  - Preparing and adopting a water management plan,
  - Designating a water conservation coordinator,
  - Supporting the availability of water management services to water users,
  - Improving communication and cooperation among water suppliers, water users, and other agencies,
  - Evaluating the need, if any, for changes in policies of the institutions to which the water supplier is subject, and
  - Evaluating and improving efficiencies of water suppliers' pumps;
- Conditionally Applicable Efficient Water Management Practices (subject to net benefit analysis), including:
  - Facilitating alternative land use,
  - Facilitating use of available recycled water that otherwise would not be used beneficially, meets all health and safety criteria, and does not cause harm to crops or soils,
  - Facilitating financing of capital improvements for on-farm irrigation systems,
  - Facilitating voluntary water transfers that do not unreasonably affect water users, water suppliers, the environment, or third parties,
  - Lining or piping ditches and canals,
  - Increasing flexibility in water ordering by and delivery to water users within operational limits,
  - Constructing and operating water supplier spill and tailwater recovery systems,
  - Optimizing conjunctive use of surface and groundwater, and
  - Automating canal structures; and
- Other Efficient Water Management Practices (subject to detailed net benefit analysis), including:

  - Providing water measurement and water use reports, and
  - Describing pricing or other incentives.

Conservation practices are many and quite varied, and each has unique constraints. Some items are costly, such as canal lining and canal automation; while others may meet resistance from growers whose operations may be impacted due to changes such as water measurement and pricing incentives. Net benefit analyses are critical to identify the best use of limited funds; surveys of growers may determine if potentially controversial conservation measures are considered viable options.

Each of the urban service providers that have greater than 3,000 service connections are required to prepare an Urban Water Management Plan (UWMP) to define the specific BMPs to be implemented. Updated UWMPs were due to DWR in 2005. DWR will review the plans against its criteria and requirements and those of the California Urban Water Conservation Council. These programs are being implemented by purveyors within the Basin. Water conservation actions and additional opportunities to improve water conservation will be integrated into the IRWMP. Agricultural and urban water conservation programs are an important element in the overall IRWMP and will be a common element of all alternatives.

WATER SUPPLY RELIABILITY

DWR defines water supply reliability as the volume of water trusted to be delivered to a specific place at a specific time. Objectively, water supply reliability indicates a particular amount of water that can be delivered with a certain numeric frequency. A supply reliability analysis assesses such things as facilities, system operation, and weather projections. Subjectively, water supply reliability indicates an acceptable or desirable level of dependability of water deliveries to the people receiving the water.

Efforts to increase water supply in the IRWMP Region will involve reducing stress on groundwater during normal or wet periods so that additional supplies can be pumped during dry times, and using the storage of groundwater to smooth out the natural supply variability due to hydrologic conditions. In its simplest terms, water supply reliability in the Kings Region depends on three general factors:

1. **Availability of water from the source.** This is the natural source or sources of the water from which the supplier draws—the particular watercourse or groundwater basin. In the Kings IRWMP Region, this includes the Kings Groundwater Basin and the Kings and San Joaquin Rivers. Availability of water from the source depends on the amount and timing of precipitation and runoff, or "hydrology," which provides water to the stream or groundwater basin, and the anticipated patterns of use and consumption of the source water by others, including water returned to the source after use. In addition, the water rights and entitlements are managed in accordance with the KRWA policies and guidelines.

2. **Availability of conveyance.** The means for conveying the water from the source via pumps, diversion works, reservoirs, canals, etc., to its point of delivery needs to be considered. The ability to convey water from the source depends on the existence and physical capacity of the diversion, storage, and conveyance facilities and also on any contractual, statutory, and regulatory limitations on the use of the facilities. This factor also describes the facilities available to capture and convey surface water or groundwater and the institutional limitations placed upon the facilities. The facilities and institutional limitations may be assumed to be those currently existing. Alternatively, predictions may be made regarding planned new facilities. Assumptions made about the institutional limitations to operation—such as legal, contractual, or regulatory restrictions—often are based upon existing conditions. Future changes in conditions that affect the ability to convey water usually cannot be predicted with certainty, particularly the regulatory and other institutional constraints on water conveyance.
3. **The level and pattern of water demand at the place of delivery.** The level of demand for water at the place of delivery is defined by the magnitude of the demand, types of uses, local weather patterns, costs, and other factors. Supply from a water system may be sufficiently reliable at a low level of demand but may become less reliable as the demand increases. In other cases under increased demand, the water supply system may be able to deliver more water than in the past and maintain its reliability because use of the system's facilities had not previously been maximized. This factor includes the amount and pattern of demand upon the water system. Demand can have a significant effect upon the reliability of a water system.

Improving water supply reliability is a primary purpose for the IRWMP and is not regarded as a unique or specific water management strategy. Instead, all of the proposed water management strategies are intended to increase the reliability in the Region. Assumptions about the future will need to be made in each of these areas for the Kings IRWMP, and how reliability within the Kings Basin is to be defined is an important consideration when establishing planning assumptions for the future. Specific performance measures will be used during the alternatives evaluation to document improvements to water supply reliability.

Surface Storage

Surface storage is the use of on- or off-stream reservoirs to collect water for later release and use. Pine Flat Reservoir has played an important role in the Region where the pattern and timing of water use does not match the natural runoff pattern and provided historical benefits as part of the area's conjunctive management and flood control effort. KRCD, KRWA, and the U.S. Army Corps of Engineers (USACE) manage Pine Flat Reservoir and upstream reservoirs to provide storage for KRWA members. Smaller storage projects include reservoirs on the Fresno Stream group that provide flood control and some storage benefits.

Prior project proposals include the Rogers Crossing Reservoir, Dinkey Creek, and Pine Flat Afterbay storage projects, all of which have been set aside due to regulatory compliance

constraints and the limited probability of project development in a reasonable timeframe. As the California and regional water pictures change, these large-scale projects may be reevaluated. However, building large-scale surface storage in California and the nation as a whole is difficult because most of the prime sites already have been dammed; and regulatory, political, and economic constraints make planning for and construction of dams extremely slow and difficult. Small-scale reservoir projects may hold more promise due to the significant expense of developing large-scale surface storage.

Specific surface storage projects currently are not identified for inclusion in the IRWMP. Large-scale surface water projects are not near-term strategies for inclusion, but they will be noted for further consideration as part of the long-term approach to meeting IRWMP goals and objectives. In the future, if climate patterns change and global warming results in reduced snow pack and increased winter runoff, the priority for surface storage for water supply and flood control purposes could change.

Desalination

Desalination is a water treatment process for the removal of salt from water for beneficial use. Desalination effectively is used not only on seawater, but also on low-salinity (brackish) water from groundwater or other sources. In California, the principal method for desalination is reverse osmosis. This process also can be used to remove other specific contaminants in water, such as trihalomethane precursors, volatile organic carbons, nitrates, and pathogens. The benefits of desalination include:

- Increased water supply,
- Reclamation and beneficial use of waters of impaired quality,
- Increased water supply reliability during drought periods,
- Diversified water supply sources,
- Improved water quality, and
- Public health protection.

The constraints for desalination in the Region include lack of saline water sources, cost for plant construction and operation, and brine disposal. These constraints limit the applicability of desalination for the IRWMP Region. There are no opportunities for desalination, and it is not recommended as part of the IRWMP.

Floodplain Management and Stormwater Capture

Floodplain Management

Floodplain management includes all structural and non-structural management measures to protect life and property while preserving natural ecosystem functions in the stream channels. In the past, many floodplain management projects were developed primarily to reduce

property damage. They did not consider the importance of floods in maintaining a healthy environment. Likewise, some ecosystem restoration was done without considering long-term floodway maintenance. Multi-objective projects are more effective than single-purpose projects. Government and the private sector are more likely to gain public support for projects with many benefits.

The California Floodplain Management Task Force issued the Final Recommendations Report in 2002, identifying local and state actions to improve floodplain management and reduce the risk to life and property. In January 2005, DWR released "Responding to California's Flood Crisis," outlining information and recommendations that provide a starting point for discussion and evaluation of local programs in the IRWMP Region. To assist the Water Forum in defining opportunities for the Region's floodplain management strategy that can be integrated into the IRWMP, a combination and synthesis of recommendations and sample actions from the two reports is provided and includes:

- Ensuring the integrity of existing flood project infrastructure through improved maintenance programs that balance public safety and needed environmental protection;
- Evaluating the integrity and capability of existing flood control project facilities and preparing an economically viable rehabilitation plan;
- Improving the effectiveness of emergency response programs;
- Creating sustainable funding to support flood management programs;
- Updating floodplain maps and providing better education on flood risks to the public and agencies that authorize development in floodplains;
- Where feasible, implementing a multi-objective management approach for floodplains that includes, but is not limited to, increased flood protection, ecosystem restoration, and farmland protection; and
- Evaluating potential policies and procedures that may determine state and local capacity to fund levee maintenance, infrastructure improvements, and emergency response.

State bond funding also may be available in the near future to help meet local needs and priorities; and where necessary, a plan for projects to improve flood control facilities could be included in the IRWMP.

City and county planners in the Region typically recognize the value of floodplains by directing development away from them, avoiding or minimizing the need for major flood control structures. By encouraging wise land-use decisions along river corridors, floodplain management can save lives; improve ecosystems; reduce property and livestock losses; and provide more open space, including agricultural lands and native habitats.

Reconnecting rivers to floodplains helps ecosystems and increases groundwater recharge, benefiting groundwater supplies. Due to the highly developed nature of the Kings River in the IRWMP Region, there are limited opportunities to reconnect rivers to floodplains without

significant effect on private property. The existing levy system protects primarily rural agricultural lands, and the system is well maintained by KRCD.

In lieu of major changes to the existing floodplain management approach, artificial systems of ponds could be used to manage floodwater, serving either to percolate water as part of a conjunctive use program or hold water as small-scale storage. There are both near-stream and off-stream areas where this type of project could be developed in the IRWMP Region. Small-scale surface storage could be a design element for any regional recharge facility or may be pursued by individual growers or water districts in the IRWMP Region. It is not expected that stand-alone levy improvement or floodplain management projects on the main stem of the Kings River will be identified or included in the IRWMP, though additional floodplain management projects or policies may be identified in cooperation with the Water Forum and integrated as elements into the IRWMP were feasible.

Regional Stormwater Capture and Management

Regional flood operations include integrated and coordinated operations of available flood storage in upstream reservoirs and local retention and detention of stormwater. This also may include redirecting flood flows to regional conjunctive use facilities to help manage high flows, provide recharge benefits, improve water quality, and provide incidental environmental benefits where possible.

Even with the efficient operation of Pine Flat Reservoir, there are wet years when USACE must release water during flood operations. AID, CID, FID, and other KRWA members divert flood flows for direct use or groundwater recharge; but often there is little demand for the floodwater, or existing conveyance facilities are already full since they are used to convey and manage local stormwater. Uncontrolled creeks within the Kings River system, notably Mill Creek, continue to challenge management of Pine Flat Dam and Kings River flood control during consecutive large-storm events. In the event of a major release from Pine Flat Dam, downstream flooding could occur over agricultural lands near the riverbanks and possibly within the Cities of Reedley and Kingsburg.

Stormwater and flood releases cannot be managed adequately with existing facilities, and water leaves the IRWMP Region in wet years. The IRWMP will evaluate capture and management of the water that flows out of the IRWMP Region to identify opportunities to integrate more regional flood operations to enhance or expand groundwater recharge. This includes evaluating improvements to existing facilities, new conveyance and recharge facilities, stable funding, current flood operations at the regional and district level, and consistency with the KRWA 1992 Floodwater Agreement.

The Floodwater Agreement documents that when flood releases from Pine Flat Reservoir exceed the total demand of all KRWA members within the Kings River POU, permitted uses of otherwise unused water is prioritized as follows:

- By KRWA members for use outside the Kings River POU but within Fresno, Kings, or Tulare Counties to facilities owned by KRWA members;
- By KRWA members for use outside the Kings River POU but within Fresno, Kings, or Tulare Counties to facilities not owned by KRWA members; and
- By anyone else with the written consent of all KRWA members.

Local Example of Small Scale Storage and Wetlands Project

On a 6,000 acre parcel of private property in the Lower Basin, an integrated wetlands/flood storage project was constructed using the U.S. Department of Agriculture's (USDA's) Wetlands Reserve Program funding. Through conservation easements, a seasonal wetland was constructed that provides habitat and 12,000 to 18,000 af of floodwater storage that is subsequently used for agriculture.

The floodwater that flows out of the IRWMP Region is either:

- Entitlement water released as part of the flood operations but not diverted by the entity with an entitlement ("refused water"), or
- Uncontrolled and unallocated flood flows that are beyond any entitlement or any organization's ability to make claim to the flow.

As described in the Surface Storage section above, a number of large-scale surface-water storage projects have been evaluated but have not been developed due to economic and institutional constraints, and additional large scale surface storage for supply and flood control is not a near- or mid- term water management strategy to be included in the IRWMP.

Small-scale storage ponds may be constructed for purposes of regulating deliveries, retaining floodwaters, providing habitat, and improving conjunctive use opportunities. The concept is to use low-lying areas in the IRWMP Region along the Kings River floodway or other major conveyance to construct temporary storage in areas where recharge may be limited. This does not include ponds that are constructed specifically for purposes of recharge, but would include ponds in areas where the presence of clays or other impermeable strata would limit recharge, and allows for short-term water storage before spreading or percolating into other facilities more appropriately designed for recharge. Such short-term flood storage could be accomplished and would provide multiple benefits related to habitat creation, sediment settling, detention storage, and regulatory storage to optimize water delivery infrastructures. When not fully used for water storage, the property could be used for specific types of farming operations. These are viable water management strategies that should be carried forward and considered by the Water Forum for integration into the IRWMP.

There are also times when 215 floodwater is available for purchase from USBR. Floodwater from the Friant Unit is routed down the Friant-Kern Canal where the water can be released to the Kings River. Opportunities exist to purchase water from USBR, and this water management strategy is to be carried over for further consideration and integration with other IRWMP elements.

Local Stormwater Capture and Management

Multiple Use and Multiple Objective Flood/Recharge Facilities

The Cities of Fresno and Clovis, through FMFCD and with the assistance of FID, capture stormwater through joint use facilities designed for both flood control and groundwater recharge purposes. Some recharge/retention ponds also provide recreational and open space benefits. The Fresno and Clovis General Plans, FMFCD Service Plan, and FID policies provide good examples of how recharge/retention ponds and canal facilities can be integrated to meet multiple objectives.

The majority of flood problems in the IRWMP Region have been associated with small local watersheds and unregulated local streams. Increased urbanization also may result in increased paved areas and runoff. This serves to change the local conditions and may affect groundwater recharge of natural precipitation. Combined local recharge and stormwater retention facilities could mitigate both flood and groundwater impacts of new development.

Small, localized projects for capture of local runoff from small watershed and the urbanized areas could be developed to provide both flood control retention and detention storage and recharge to meet multiple objectives.

Advanced planning; the development review process; acquisition of land; and coordination between the flood control, water supply, and land use agencies would serve to mitigate both flood runoff and the lost recharge from urbanization. The IRWMP provides the opportunity to review and/or adopt policies for this purpose.

Local irrigation district facilities in AID, CID, and FID are used to convey stormwater around or away from urbanized areas during flood events, but funding for flood control uses for the facilities is not always part of the recognized benefits or local funding equation. Flood related impact fees and benefits assessments could provide funding for improved capital facilities to convey floodwater. Integrated local projects for stormwater and recharge are water management strategies that should integrated into the IRWMP.

Constraints

Reconnecting rivers to floodplains would involve significant expense to realign levees and infrastructure, take land out of production or purchase flood easements. These constraints limit the applicability of this flood plain management strategy in the Region.

The technical engineering constraints to develop floodwaters vary by location in the IRWMP Region and are associated primarily with limitations of conveyance systems to move water to recharge areas, and lack of recharge and spreading facilities.

Existing irrigation infrastructure has lower capacities further down into the watershed since these systems are for water delivery. Flood control systems increase in size in the downstream direction to capture and convey floodwater. This contrary design and purpose needs to be reconciled. Some, but not all, local areas have policies that require system improvements at the time of development (e.g., piping open canals). This provides a local solution but may not recognize regional flood or water supply impacts. Localized flood control operations for stormwater management can limit the ability for these systems to capture regional flood releases from Pine Flat Reservoir or to import and convey 215 floodwater for groundwater recharge operations.

Institutional issues also may provide constraints on development of available floodwater as a source of surface supply for recharge. Constraints to stormwater capture and management are also related to land acquisition and include high cost, lack of capital to acquire land when available, and/or lack of policies or institutional arrangements that require mitigation on new development for flood control and recharge facilities.

Competition for available floodwater could delay project development. In addition, unless locally developed, water leaving the area could be subject to claim by downstream interests. Developing cost-effective engineering solutions to capture and store floodwater is challenging because of the intensity and infrequency of major storm/runoff events.

There are constraints to usage of 215 floodwater due to funding, facilities, conveyance, and flood control. Existing canal facilities often cannot be used because 215 floodwater is usually available at times when the Kings River is already flowing; existing AID, FID, and CID facilities are full of local storm runoff or diversion from the Kings River; or conveyance losses down the Kings River dissuade lower Kings River water users from purchasing available water because only a percentage of what they purchase reaches their point of diversion. Each district makes independent decisions on acquisition of 215 floodwater, and there is no formula for acquisition or funding of this water for regional, groundwater recharge purposes. 215 floodwater also is not purchased because revenues for this purpose are not identified.

WATER QUALITY MANAGEMENT

Water and Wastewater Treatment

Water and wastewater treatment include infrastructure necessary to protect water quality and comply with state and federal requirements designed to protect public health and safety and the environment. This includes treating drinking water to meet standards and treating wastewater

such that it can be safely discharged without impairing other water users, groundwater, or the environment.

Dinuba's Integrated Project

The City of Dinuba has proposed an integrated project that includes irrigating a golf course with reclaimed wastewater, constructing wetlands to further polish the treated wastewater and provide habitat and educational and recreational opportunities.

There are opportunities to build additional drinking water treatment plants that would increase the use of surface water in lieu of groundwater pumping, thus leaving water in groundwater storage for use at times when surface water supplies are not available. Such systems also may be needed to respond to water quality issues that currently affect groundwater supply reliability.

As part of the conjunctive use strategy, additional facilities to treat surface water are being proposed by the City of Fresno within the FID area for the southeastern part of the city. AID also is evaluating surface water deliveries and treatment to provide water to municipal agencies as part of an in-lieu program. AID has fewer viable locations for direct recharge as compared to CID and FID; treating and delivering surface water in lieu of groundwater pumping is one approach for AID to increase groundwater storage and reduce overdraft. Such facilities also will increase the overall supply reliability and ensure high quality water is available for municipal and domestic requirements.

The IRWMP Planning Framework includes a project definition process to work with the incorporated cities and unincorporated communities to identify municipal treatment needs and define priority projects. The IRWMP could include a capital facilities plan and priority list for municipal and domestic drinking water projects, and document the needs of disadvantaged communities that have problems meeting drinking water standards.

The IRWMP Planning Framework and project definition effort will document opportunities and needs for WWTP improvements or new facilities where necessary to protect water quality and meet regulatory standards. New or improved wastewater treatment facilities may help to expand in-lieu opportunities where reclaimed water can be substituted for groundwater pumping or where groundwater recharge with tertiary treated wastewater could increase the overall yield of the IRWMP Region.

Where possible, facilities designed to meet the needs of multiple stakeholders should be identified to increase cost effectiveness and scale economies.

Constraints

Constraints primarily are related to the costs associated with upgrade, construction, operation, and maintenance of capital facilities. Establishing project priorities, defining regional versus local benefits, and combining individual local projects into the IRWMP will present challenges

to the Water Forum. Additional constraints include land acquisition, the environmental review process, and designing institutional arrangements for shared facilities.

Water Quality Protection and Improvement

DWR's Bulletin 160-05 describes water quality protection and improvement as pollution prevention, matching water quality to water use, and groundwater remediation/aquifer remediation. If water quality is degraded beyond its ability to be used for municipal and agricultural purposes, the supply essentially is diminished or the treatment cost is increased. Protecting existing water quality is a way of ensuring reliable supply.

Pollution Prevention

For the vast majority of contaminants, it is generally accepted that a pollution prevention approach to water quality often is more cost-effective than end-of-the-pipe treatment of wastes or advanced domestic water treatment for drinking water. Pollution prevention measures usually are more cost-effective because they have lower initial capital costs, as well as less ongoing operations and maintenance costs, than traditionally engineered treatment systems. However, because of the nature and sources of some contaminants, a pollution prevention approach may not be possible, cost-effective, or even desirable in some instances. Small water systems, which generally lack technical and financial capacities, may be more reliant upon pollution prevention measures than other options available to larger systems such as advanced treatment. Pollution targeted for prevention may include urban runoff, agricultural drainage, and natural sources.

There may be further opportunities for the local land use agencies and water districts to develop non-regulatory, voluntary programs to protect water quality through community outreach and education intended to provide information that will reduce polluting activities. These programs would be similar to those already in place that encourage homeowners to recycle household hazardous waste or that provide growers with information to improve fertilizer and pesticide management.

Matching Water Quality to Water Use

For agricultural and in-stream uses, water quality matching may be an integral part of water quality management because there generally is no treatment of these water supplies prior to agricultural use. For drinking water, appropriately matching high quality source waters can reduce the levels of pollutant and pollutant precursors that cause health concerns in drinking water. In addition, less costly treatment options can be used when water utilities start with higher quality source waters and water supply reliability simultaneously can be enhanced.

In the Kings Region, providing treated surface water for municipal uses in lieu of groundwater, is a strategy for matching water quality to use since groundwater underlying many municipal

areas is of reduced quality and may require treatment. This approach also provides groundwater storage benefits. The groundwater of diminished quality can continue to be applied to non-potable municipal uses such as landscape irrigation.

Groundwater Remediation/Aquifer Remediation

Groundwater remediation involves extracting contaminated groundwater from the aquifer, treating it, and discharging it to a water course or using it for some other purpose, or injecting it back into the aquifer. Contaminated groundwater can result from a multitude of both naturally occurring and anthropogenic sources. Remediation results in an additional water source that would not be available without remediation, but groundwater treatment is expensive and years or decades may be required to remediate contaminated groundwater sites.

There is a wide array of local and state regulatory programs in the IRWMP Region whose purpose is to prevent pollution of surface water and groundwater. An inventory of these programs will be included in the pending Water Quality Baseline Report. It is not anticipated that additional regulatory programs would be recommended for inclusion in the IRWMP; instead, the IRWMP will identify opportunities to integrate and better coordinate the existing programs where feasible.

There may be additional opportunities to better integrate existing groundwater and aquifer remediation programs, and these will be further investigated after the Water Quality Inventory has been produced as part of the IRWMP. These opportunities will be identified in cooperation with the Water Forum during the project definition tasks, feasibility studies, and alternatives evaluation efforts of the IRWMP.

Water Quality Monitoring

The IRWMP also will identify opportunities to improve water quality monitoring, including ways to improve the existing monitoring network, share data from existing monitoring programs, and document priority water quality problems so that regional and local solutions can be developed and prioritized. The improved network would help to identify water quality problems and document the water quality benefits of the IRWMP programs.

Control of Nonpoint Sources of Pollution

Nonpoint sources (NPS) of pollution originate from otherwise legal uses of land and are contributed to a waterway from widely dispersed sources as a result of generally accepted societal practices and situations where individual liability and responsibility are hard to determine. The purpose of the state's NPS Program Plan is to improve the ability to effectively manage NPS pollution and conform to the requirements of the Federal Clean Water Act (SWRCB, NPS Plan, 2000). In the IRWMP Region, total dissolved solids (TDS) and nitrates in

groundwater are of primary concern. TDS and nitrates are contributed both by agricultural and municipal sources.

Existing local NPS pollution control programs have been described in the Baseline Inventory Report (WRIME, 2006) and will be further documented in the Water Quality Inventory Report that is to be produced. Existing programs include the incorporated cities' efforts to improve urban runoff consistent with the NPS pollution stormwater program and the agricultural waivers program managed by KRCD to reduce runoff to surface water from farming operations in the IRWMP Region.

Voluntary Rangeland and Foothill Water Quality Guidelines

KRCD, working with the Sierra Resource Conservation District (RCD), Westside RCD, and Navelencia RCD, adopted the "Voluntary Rangeland and Foothill Water Quality Guidelines" in 2000, and the RCDs continue to promote the effort and provide technical support to private land owners.

There may be further opportunities for local land use agencies and water districts to develop non-regulatory, voluntary programs to protect water quality through community outreach and education intended to provide information that will reduce NPS pollution. No additional programs for NPS pollution control program at the local level have been identified for inclusion in the IRWMP at this time. Additional actions to better integrate existing programs or to expand local or regional programs to control NPS pollution may be identified as the IRWMP moves forward, and other structural and non-structural management actions may be integrated into the IRWMP. It is anticipated that existing monitoring programs currently underway as part of the NPS pollution control effort will be integrated into the final IRWMP monitoring program.

Watershed Planning

Watershed management is the process of evaluating, planning, managing, restoring, and organizing land and other resource uses within an area of land that has a single common drainage point. Watershed management tries to provide sustainable human benefits while maintaining a sustainable ecosystem. Watershed management assumes that a prerequisite for any project is the sustained ability for the watershed to maintain the functions and processes that support the native ecology of the watershed. This does not imply that a goal is to return the watershed to an undisturbed condition. Instead it implies an integration of human needs and ecological condition that allows the watershed to sustain ecological integrity over time while providing for sustainable community needs. It is recognized that watersheds are dynamic, and the precise makeup of plants, animals, and other characteristics will change over time. Watershed management seeks to balance changes in community needs with these evolving ecological conditions.

Underpinning this management is the need to understand ecological processes important to the local watershed. One approach to understanding these processes is to describe various ecological cycles and watershed traits such as the hydrologic cycle, nutrient cycling, energy flow and transfers, soil and geologic characteristics, the role of fire, and animal migration and habitat use. Understanding these watershed processes allows for adaptively managing the watershed. In some cases the description of these processes will point out that some infrastructure, programs, or projects are not sensitive to watershed processes. In these cases reoperation or redesign of the infrastructure, programs, or projects may greatly improve their compatibility with the watershed processes.

Outside of the IRWMP Region in the upper part of the Kings River watershed above Pine Flat Reservoir, there are a number of watershed planning efforts are occurring through the Resource Conservation Districts (RCDs) under existing state and local processes. Much of the land is relatively pristine and in federal ownership, and there has not been significant impairment to beneficial use. Issues in the part of the watershed are related to sedimentation from land use activities and dissolved metals in runoff water from old mining sites. The IRWMP will acknowledge the existing programs and seek opportunities to coordinate efforts.

Constraints

Within the IRWMP Region, watershed management concepts are being integrated into the conjunctive use/groundwater management, water quality, and ecosystem project categories were feasible. Constraints to developing new water quality protection and improvement projects are related to funding and funding capacity of existing agencies, political acceptability, and interagency coordination. There currently is no specific structural or non-structural watershed management actions anticipated in this area beyond those actions which are already proposed for integration into other project categories.

Ecosystems Management

The Environmental Baseline Report will be published as part of the IRWMP process and will help document existing environmental conditions and the ecosystem management programs that currently are operating in the IRWMP Region. This section conceptually describes how the programs and projects can be integrated to meet IRWMP goals for ecosystem enhancement.

Ecosystem Restoration

Many of the Region's ecosystems cannot be restored to their natural state, nor is that degree of restoration desirable. Instead, ecosystem restoration focuses on rehabilitating ecosystems so that they supply important elements of their original structure and function in a sustainable manner. Ecosystem restoration and protection can be viewed as the proper maintenance of the IRWMP Region's natural infrastructure. Ecosystem restoration typically involves integration

with other water management strategies to reduce conflicts, expedite permitting, and provide a more cost-effective solution.

The Kings River Fisheries Management Program, which provides fisheries and recreation benefits, is a prime example of a beneficial ecosystem restoration program. The IRWMP will investigate and identify other opportunities, where feasible, to enhance or restore habitat function, including:

- The City of Dinuba's proposed program to develop wetlands with reclaimed wastewater to provide habitat and water quality benefits;
- Dedicated regional and local recharge facilities that could provide valuable seasonal wetlands habitat;
- Flows intended for direct or in-lieu recharge that could be part of the Kings River Fisheries Management Program and increase the regional benefits of the projects; and
- Wetlands reserve-type programs that could provide water storage and additional recharge benefits in the lower part of the IRWMP Region.

Additional opportunities to define restoration projects or to integrate restoration-related functions into proposed projects will be identified in the project definition tasks, feasibility studies, and alternatives evaluation efforts of the IRWMP.

The San Joaquin River will be subject to a fisheries restoration program pursuant to settlement agreements resolving long standing litigation *(NRDC v. Rogers)*. This will effect future flow conditions, fishery conditions and recharge rates. The changes to the San Joaquin River flows under the proposed settlement will be factored into the assumptions for the future, no project conditions in the Kings Region.

Environmental and Habitat Protection and Improvement

Whereas environmental restoration is to recreate habitat, environmental and habitat protection and improvement are intended to preserve existing conditions, or make marginal enhancements to the current conditions, respectively.

The pace of development in the IRWMP Region reduces the amount of farmland, and there are limited undisturbed natural areas with habitat value that could serve as preservation opportunities. The Environmental Baseline report will document current conditions and identify areas where there may be opportunities to protect existing habitats and ecosystem functions.

Local Example of Ecosystem Protection

FMFCD's rural streams program seeks to preserve, restore, and maintain rural stream channels. This, in conjunction with a Memorandum of Understanding with the California Department of Fish and Game (DFG), helps provide long-term net benefits for fish, wildlife, water quality, native plants, and stream habitat, while maintaining or improving regional flood protection.

The riparian corridor along the Kings River provides very valuable habitat, and King River Conservancy has produced "The Kings Ribbon of Gems, A Vision for the Lower Kings River," which documents opportunities to enhance, preserve, and protect the Kings River aquatic, wetland, and riparian resources. To the north, the San Joaquin RCD is conducting similar management actions. There may be additional opportunities to mitigate impacts of new development that affects habitat. To the degree possible, the IRWMP will anticipate, minimize, mitigate, and avoid any impacts to existing habitat during the design phase, rather than waiting until the environmental review and permitting stage. In addition, the IRWMP is seeking to actively engage the RCDs and the public to identify environmental enhancement and protection opportunities.

Wetlands Enhancement and Creation

Wetlands enhancement and creation is a subset of ecosystem restoration and floodplain management and is related to enhancement or creation of specific wetlands habitats. Wetlands habitat is unique and provides important ecosystems benefits to local and migratory species. Much of the ancestral wetlands habitat in the San Joaquin Valley and IRWMP Region has been lost.

The planning area has been highly modified and extensively developed, and there are limited natural habitats or lands to protect and enhance. This makes protection of that which remains all the more important. Much of the valuable habitat is in private ownership. It is difficult to demonstrate and quantify economic benefits of restoration and protection projects.

Within the Basin, there may be opportunities to restore wetlands or provide wetlands habitat incidental to other IRWMP projects. The USDA's Wetlands Reserve Program has provided funding for projects in the region and helped develop projects that provide an example of a multiple benefits. The IRWMP will seek to integrate ecosystem benefits into direct recharge and conjunctive use projects that may be developed.

Specific land areas (project sites), water supply sources, and operational regimes for the proposed recharge projects need to be defined prior to identifying specific environmental concepts that could be incorporated into the design to provide habitat/ecosystem benefits. Once the engineering project concepts are further developed, it would then be appropriate to work with DFG, the Natural Resources Conservation Service, and other entities to refine design element, seek additional funding, and work to avoid environmental impacts. Incorporating ecosystem or "green" concepts into the project design will increase the likelihood of funding and permit approval.

Constraints

Constraints include costs and land or easement acquisition; funding for restoration projects, feasibility for integration of restoration elements into proposed projects, regulatory constraints, and political acceptance. Other constraints to integrating habitat into recharge pond designs and providing habitat benefits include:

- Maintaining habitat stability (e.g., ensuring a facility will not go dry after creating a habitat for and attracting nesting birds),
- Addressing growers' concerns for spillover of endangered species onto adjoining lands,
- Controlling weeds at the project site,
- Creating habitat for and attracting invasive species, and
- Providing mosquito abatement.

LAND USE AND RECREATION

Land Use Planning

In general, past informational requirements for water management planning were minimal and largely avoidable. Most city general plans addressed water in the public service and utilities sections with minimal regard to regional water supply issues. County general plans usually acknowledged regional issues such as overdraft but County policies do not apply to lands upon annexation to a city. Each local planning agency carries a responsibility to coordinate its general plan with regional planning efforts, but historically there have been limited mandates for water supply analysis or integration of the general plan with a water supply plan. In the past 10 years there have been changes in the legal requirements for coordination of land use and water supply plans[5]. The need for close coordination between land use and water supply plans has received the attention of both the legislature and courts. In 2000 the legislature passed Senate Bill (SB) 221 and SB 610 that made significant changes to the requirements for land use and water planning. Both sought to improve the integration of water and land use decisions, and required detailed analysis of water supply for large-scale projects before the projects could be approved. Over the past 10 years, the courts have interpreted CEQA in ways that place more requirements on agencies to integrate land and water use decisions[6] and further require substantial evidence of a sufficient water supply prior to project approval.

Previously, planning for land use and water supplies was conducted by different agencies, at different times, for different planning horizons to meet widely varied objectives, often using

[5] A more detailed treatment of the integration requirements can be found in Waterman, 2004 (see reference).

[6] See *Stanislaus Natural Heritage Project v. County of Stanislaus*, 48 Cal. App. 4th 182 (1996); *County of Amador v. El Dorado County Water Agency*, 76 Cal. App. 4th 931 (1999); and *Santa Clarita Org. for Planning the Env't (SCOPE) v. County of Los Angeles*, 106 Cal. App. 4th 715 (2003).

different methodologies, assumptions, and data. This resulted in inconsistencies in the plans and poor coordination of public investments and subjected agencies to legal challenges.

The Water Forum and IRWMP process provide an opportunity to integrate land and water supply plans, where appropriate, in order to meet current and future water needs, streamline subsequent project reviews, and avoid potential legal challenges and project delays.

Creating a consistent planning horizon and set of demand-and-supply assumptions between land use and water supply plans will help to avoid conflicts and make both types of plans more defensible and less subject to legal challenge. The future land use and planning horizon assumptions will provide the basis for calculation of future water demands. The future water demands will provide the basis for planning and design of new supplies and requirements for conservation. The future water demand scenarios for alternatives analysis will be created using city and county growth projections and land use changes and for development of the no action or no project alternative. Creating common assumptions for both the land use and water supply plans will provide benefits to cities because their growth projections and long-term water needs will be included in the IRWMP technical information and analysis, and the IRWMP results can be used to expedite and support future updates to the land use and general plans and project reviews.

Recreation and Public Access

Recreation and public access includes the management of lands and water resources by local, state, and federal public agencies under an implied principle of public trust responsibility. State or federal agencies managing lands and water resources are required to uphold public trust in the planning, management, use, and protection of resource values. As trustee to public resources, the state and federal agencies must consider the benefit and use of land and water resources for recreational opportunities. Natural resource values often define the character and aesthetic appeal of water-dependent recreation, making it desirable and interesting to visitors. Poorly planned use, misuse, or overuse of any recreation resource can degrade natural resource values and recreational experiences.

Water management can affect the amount or timing of stream flow. This may have a positive or negative effect on recreation. The IRWMP will consider the effects of all proposed actions on resource values, including recreation and ecosystem health.

There are opportunities to protect or develop recreational features in the Region. The Kings River Conservancy Vision for the Lower Kings River (September 2005) provides a good starting point for discussing recreation opportunities in the riparian corridor from Pine Flat Dam to Highway 99. A number of gravel mining operations are proposed for the area covered by the Kings River Sub Regional Plan of the Fresno General Plan. An update of the plan to accommodate additional gravel mining is being discussed at the county level, and one concept

being promoted by environmental interests is to generate revenue for open space access and land acquisition through an assessment on the gravel mined from areas along the Kings River.

Providing public recreation benefits and planning to integrate benefits into projects may increase the cost effectiveness and political acceptability of projects and increase the probability of voter approval for needed benefits assessments. The IRWMP project definition, feasibility analysis, and alternatives evaluation will seek to define further opportunities to provide active and passive recreational benefits.

Cost, timing, liability, and other issues may constrain the ability to integrate recreational benefits into the IRWMP. There is no region-wide parks district to coordinate open space and parks planning, and no Fresno County or Tulare County park master plans have been identified. The 1981 Kings River Sub Regional Plan is part of the Fresno General Plan, but it has not been updated.

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